

Theory of Operation/Technical Description – FCC ID: WAP3028, IC: 7922A-3028

RF circuit function:

The whole RF circuit including the transmitter path and receiver path is formed inside the main Bluetooth chip, not discrete device.

The RF part features a fully integrated transmitter. The baseband transmit data is GFSK modulated in the 2.4 GHz ISM band. The digital modulator performs the data modulation and filtering required for the GFSK signal. The fully digital modulator minimizes any frequency drift or anomalies in the modulation characteristics of the transmitted signal. The integrated power amplifier (PA) can transmit up to +4 dBm for class 2 operation.

| Parameter | Min | Typ | Max | Unit |
|------------------------|------|-----|------|------|
| Transmitter Section | | | | |
| Frequency range | 2402 | – | 2480 | MHz |
| Class 2: GFSK Tx power | – | 2.0 | 4.0 | dBm |

The receiver path uses a low IF scheme to downconvert the received signal for demodulation in the digital demodulator and bit synchronizer. The receiver path provides a high degree of linearity, and an extended dynamic range to ensure reliable operation in the noisy 2.4 GHz ISM band. The front-end topology, which has built-in out-of-band attenuation, enables to be used in most applications without off-chip filtering. The digital demodulator and bit synchronizer take the low-IF received signal and perform an optimal frequency tracking and bit synchronization algorithm. The radio portion provides a receiver signal strength indicator (RSSI) to the baseband. This enables the controller to take part in a Bluetooth power-controlled link by providing a metric of its own receiver signal strength to determine whether the transmitter should increase or decrease its output power.

RF signal flow:

The output of the chip radio goes through an output filter and a matching network to the antenna. The filter consisting of LC4/LC5/LC6 removes the harmonics and the matching network consisting of LC1/LC2/LC3 transforms the antenna's impedance to 50 ohm.

Description of Antenna system (Baluns, Multiplexers)

The output of the chip radio goes through an output filter and a matching network to the chip antenna. The chip antenna gain is -1dBi max.

Show compliance with 15.203 antenna requirements:

The module uses chip antenna which is permanently on the module. Further there is no provision for a standard antenna jack. So the antenna is not user replaceable and meets the requirements of 15.203 of FCC.

Description of all modulation schemes used in the product:

Modulation used in the radio is Gaussian Frequency Shift Keying. It also incorporates $\pi/4$ -DQPSK for 2 Mbps and 8-DPSK for 3 Mbps to support EDR. The following are the details

1. Operation Frequency: 2402 MHz to 2480 MHz
2. No. of Channel: 79 for BT Classic; 40 for BT LE
3. Channel Spacing: 1MHz for BT Classic; 2MHz for BT LE
4. Modulation type: GFSK/ $\pi/4$ -DQPSK/8-DPSK
5. Data Rate: 1 Mbps/2 Mbps/3 Mbps
6. BT constant: 0.5
7. Modulation index: 0.32 for BT Classic; 0.5 for BT LE

Bluetooth Classic and Bluetooth Low Energy can't work simultaneously for there is only one RF path.